REMARKS

Claims 1and 6-17 remain pending in this application. Claims 1 and 6-17 are rejected. Claims 1, 6 and 13-16 are amended herein to clarify the invention, to express the invention in alternative wording, to broaden language as deemed appropriate and to address matters of form unrelated to substantive patentability issues.

The applicant and applicant's attorney appreciate the Examiner's granting of the telephone interview conducted on October 23, 2006, and extend their thanks to the Examiner for her time and consideration. While no formal agreement was reached, applicant discussed various aspects of the invention as pertaining to the pending claims to clarify applicant's position in consideration of, and opposition to, the rejections of record.

In particular, it was pointed out to the Examiner that none of the references teach the simultaneous passage of cleaning agents, such as ice, through parallel pipes interconnecting headers. The Examiner indicated that she would give consideration to withdrawal of the present rejections of claims 13-17 by amendment of the claims to positively recite the step of simultaneous passing the ice and water mixture through two coil pipes arranged between headers, rather than having the limitation recited in the step of applying suction. The claims are amended accordingly.

Applicant's counsel also explained the position that the amendment from 150mm to 15mm (internal pipe diameter) does not introduce new matter, since the

size ratio taught in the specification makes such change merely one of establishing conformance with a remainder of the disclosure.

The remaining issue raised was that pertaining to the obviousness rejections based in part upon the primary Barry et al. reference. It was argued that Barry et al. involves a "pig" that, according to longstanding conventional practice and understanding, approximates an inside diameter of the pipe (or at least the plaque coating the pipe) to be cleaned, and therefore precise alignment of the pig with the pipe inner diameter, attendant such use, would preclude feeding the same from a hopper in an unassisted manner, as claimed. Furthermore, even if drawn into the tube, the conforming size of the pig would not allow it to pass freely through the tube, as claimed, merely by the relatively small pressure drop caused by a suction. While it would appear from the discussion that the Examiner is of the present opinion that Barry et al. does not limit the pig size, and that pigs much smaller than the pipe diameter could conceivably be used according to Barry et al., the Examiner indicated that if applicant could establish with sufficient evidence that the disclosure of Barry et al. were in fact limited to a pig of pipe-conforming diameter, she might consider the rejections as being overcome.

While no formal agreement could be reached, the remarks and amendments herein represent the above understanding had as a result of the interview.

Applicant herein traverses and respectfully requests reconsideration of the rejection of the claims cited in the above-referenced Office Action.

The amendment filed April 19, 2006 is objected to under 35 U.S.C. §132(a) because it allegedly introduces new matter into the disclosure. Applicant respectfully traverses this ruling. As noted during the above referenced interview, paragraph 0018 of the specification clearly states that "[t]he results of experiments indicate that a mixture of ice and water, which was prepared in a ratio of 1 (ice): 5 (water), is suitable and the suitable size (one side length) of an ice cube corresponds to 1/3-2/3 of the inside diameter of the coil pipe(s) to be internally washed." Thus it is clear that, given ice cubes of 5-10mm, as disclosed in the example of paragraph 0018, a pipe would have to have an internal diameter of 15 mm, as amended, and not 150 mm, since 1/3 to 2/3 of 15 mm is, as disclosed, correctly 5-10 mm. Withdrawal of the objection is therefore respectfully requested.

Claims 14-16 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. In addition, Claims 14-16 are rejected under 35 U.S.C. §112, second paragraph, as indefinite, since the terms "outlet" and "inlet" are alleged to have totally opposite meanings, and cannot therefore be used interchangeably. Applicants have renamed the inlet and the outlet headers as first and second headers, in the manner as discussed during the interview. As such, it is respectfully submitted that the rejections of claims 14-17 are overcome, and withdrawal of the rejections is earnestly solicited.

Claim 17 is rejected under 35 U.S.C. § 112, first paragraph, as it is alleged that non-corrugated pipe is not disclosed in the specification. Applicant respectfully

disagrees, as such structure is clearly shown in Fig. 5. Fig. 5 is identified as showing "an example of an arrangement of a coil pipe(s) of a heat exchanger," and the drawing thereof clearly depicts a smooth pipe having no corrugations. Since the drawings are considered part of the disclosure, using such claim language is submitted by applicant as having full support in the disclosure. Withdrawal of the rejection is therefore respectfully requested.

Before addressing in detail the substantive claim rejections below, the limitations of the disclosure of the primary Barry et al. reference are discussed, as being the primary reference applied to all rejections presently of record. As argued during the interview had with the Examiner, it is applicant's position that the "pig" used Barry is limited to a body having close conformance with a traversable interior diameter of the pipe to be cleaned. It remains applicant's position that Barry is enabling only for use of a pig dimensioned to operate as a propelled "piston" essentially forming a hydraulic seal between the pipe walls (or lumen carried thereon) and the outside of the pig. In order to be properly applied as a reference against a recited feature(s), "the prior art reference must be enabling, thus placing the allegedly disclosed matter in the possession of the public." *Akzo N.V. v. U.S. International Trade Commission*, 1 USPQ 2d 1241, 1245 (Fed. Cir. 1986), *cert. denied*, 482 U.S. 909 (1987). Thus, if it is established that the teaching of Barry et al. is limited to a pig of a generally inner-pipe conforming size, its disclosure cannot be somehow expanded to include the speculative use of an ice/water slurry which can be drawn into a heat

exchanger tube to be cleaned, by the mere application of suction, nor can it be relied upon for the indication that such slurry with have any likelihood of cleaning success in such situation if so tried. It is therefore submitted that the reference does not provide teaching in variance of or addition to such enabling disclosure, and therefore Barry cannot constitute a proper reference advanced either for the premise of using ice having a size small enough to be drawn into, and through, a heat exchanger pipe simply by application of suction from another end of the heat exchanger tube, or for the probable effectiveness of an ice/ water mixture containing ice which is so dimensioned to permit such effect, for cleaning the type of buildup associated specifically with heat exchanger pipe interiors. The issue is not whether a reference could conceivably be modified to employ teaching not specifically disclosed, but rather whether the reference, within its four corners, concretely provides such teaching in a manner enabling its practice. In the present instance, Barry et al. clearly does not teach ice having a small enough dimension to be pulled into, and through, a tube, by suction applied at the other end. Thus, applicant respectfully submits that the Examiner's position stated in the course of the interview (i.e., that since Barry et al. does not specifically preclude use of ice smaller than that in close conformance with the tube interior it can somehow be used as teaching of ice having a smaller size relative to a tube interior) is not supported by prevailing law.

In countering the Examiner's position that Barry et al. includes teaching of a pig having a reduced size relative to a tube interior diameter, applicant draws the

Examiner's attention to the numerous indications given in Barry et al. which inescapably establishes the clear and unequivocal intention of Barry et al. to use a pig having a dimension matching the inner diameter of the tube to be cleaned (or lumen coating it), and the stark absence of any teaching or suggestion whatsoever relating to use of a pig of smaller size in the cleaning of heat exchanger tubes.

Barry el al. mentions in the background that it is well known in the art "of extracting and distributing petroleum to pass a 'pig' of solid material through a pipeline to wipe deposited paraffins from the wall. Furthermore, "pigging" is a known technique in the cleaning of tubes. However the pigs used are flexible and compressible and are often provided with abrasives embedded in their outer walls or with cutting or gouging devices projecting through their outer surface. Such a pig is forced through a tube by hydraulic action mechanically gouging material from the wall of the tube and pushing debris in front of it. " (Col. 2, lines 1-11, emphasis added).

Claim 1of Barry et al. recites "said pig being dimensioned to conform with the average lumen defined by the thickness of deposits on the tube." The disclosure explains the process used to clean a heavily clogged pipe in which "cleaning is effected by several passes of pigs of increasing diameter. The diameter of the pig first passed is selected to permit it to penetrate the lumen of the contaminated tube, and the pig is launched through the tube in the manner described above. If a pig of correct diameter is selected by the operator, it is accompanied during its penetration of the

contaminant material by a flow of pressurised cleaning liquid which fills the annular space between the pig and the contaminant material. This flow of minimized cleaning medium passes the pig, the progress of which is retarded by the contaminant material. It is thought that the flow of minimized cleaning medium emerges on the downstream side of the pig as an energetic annular jet, which erodes the contaminant material ahead of the pig, allowing it to progress through the tube. This process is then repeated with a pig of larger diameter." (Col. 3, lines 36-53, emphasis added) Thus, as disclosed, even the smallest pig (first pig) is dimensioned large enough to cut through a layer of lumen coating the tube by scraping therethrough in its travel. And the pigs only increase in size thereafter.

In referring to the use of ice as a pig, Barry et al. states that a " pig of ice may also be used, for example, where a tube has been distorted during dismantling of a tube bundle or removal to a cleaning pad. An ice pigmay jam in an oval tube without serious consequences arising. (Col. 4, lines 27-31, emphasis added). Such disclosure clearly evidences the intention in Barry et al. to use a pig dimensioned to just barely clear the tube interior, as would be expected of a hydraulically driven piston element.

Barry et al. goes on to say that "[i]t is possible to machine such a pig to fit closely the particular dimensions of a tube to be cleaned. This feature is subject, of course, to a limitation in that the pig may not move at all, if there is too small a clearance. For example, clearances of between 0.01" and 0.005", desirably 0.0085",

have been found suitable with a Delrin pig used to clean a steel tube." (Col. 4, lines 32-38).

Further, Barry et al. discloses that"[i]n known pigging techniques rather complex pigs have been used, having abrasive material incorporated therein as described above. One advantage of the present method is that a simple pig may be used, for example, a simple cylinder of plastics material or a ball (where U-tubes are to be cleaned). (Col. 4, lines 39-44, emphasis added). Such disclosure is revealing of the mandate in Barry et al. to maintain close tolerance between the inner tube diameter and pig diameter, since the disclosure recognizes that a cylinder would jam going around a U-bend, and suggests the use of a ball (sphere) to avoid the problem, rather than suggesting a reduction in size of the pig.

The figures, in addition to the lacking written disclosure, fail to depict a pig that is anything but in close conformance with the tube interior. Indeed, use of a smaller pig would not work according to the functioning of Barry et al.. As pointed out by applicant's counsel during the interview, a hydraulically propelled pig under high pressure relies on an annular "seal" to create a pressure drop which operates to impart the great velocity intended by the disclosed approach. To make the pig smaller would defeat the purpose of the disclosed invention.

Finally, with such a dimensioned pig, Barry et al. requires high pressure to keep it from jamming in the tube. "Suitably the pressures used are in the range from 1,000 to 10,000 psi, preferably from 1,000 to 6,000 psi." (col. 4, lines 47-49). Surely,

with the much smaller pressure differential created by the simple application of suction (for example, a mere 14.7 psi difference between atmospheric pressure and a perfect vacuum) a pig of such nature would never be expected by the skilled artisan, based upon a reading Barry et al., to pass through a debris coated tube in a heat exchanger, as is possible in accordance with the claimed invention.

The rejections are now addressed with specific regard to the various claims and combinations of references.

Claims 1, 7, 9 and 11 are rejected as obvious over Barry (US 4,724,007) in view of Sameshima (JP01-028625) and further in view of Withers Jr. (4,007,774) under 35 U.S.C. §103(a). The applicant herein respectfully traverses this rejection. For a rejection under 35 U.S.C. §103(a) to be sustained, the differences between the features of the combined references and the present invention must be obvious to one skilled in the art.

It is respectfully submitted that a *prima facie* case of obviousness is not established in the rejection of claims 1, 7, 9 and 11. "To establish a*prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination

and the reasonable expectation of success must both be found in the prior art, and not based on the applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)." MPEP §706.02(j) "Contents of a 35 U.S.C. §103 Rejection".

The presently rejected claims are directed specifically to a method of cleaning heat exchangers, in accordance with which, a mixture of ice and water is drawn from a hopper through the heat exchange tube or tubes by applied suction. It is applicant's position that one skilled in the art would not have the requisite guidance or reasonable expectation of success by using the proffered combination of references without application of impermissible hindsight, as explained more fully below.

Barry el al., as discussed above, while relating generally to the cleaning of tubing in heat exchangers, utilizes propelled pigs under high pressurewhich, as argued during the above referenced interview, are sized to closely match an interior cross-section of the clogged tubing, such that each pig essentially operates like a high velocity piston driven by great pressure behind it, rather than using suction from the other side as a motion imparting mechanism. The invention disclosed in Barry et al. relies on such intentional dimensioning of the pig (which may be made of ice), since the functioning of the method requires a pressure build-up on the back of the pig to propel it (see, for example, col. 3, lines 7-20).

It is notable that, because of this sizing closely matching the interior diameter of the piping, jamming of ice in the tubes is a recognized problem (See col. 4, lines 27-31 of Barry), and would therefore preclude the use of mere suction, as opposed to

the disclosed high pressure, since even the slightest irregularity of the tube would cause a jam when only a small pressure drop (i.e., between ambient pressure and the applied suction) were present. Therefore, the teachings of Barry et al. cannot effectively be applied to any method which teaches the use of suction, for example as disclosed in the Sameshima reference, since its principles of operation are diametrically opposed thereto, and would be counterproductive if one were to attempt to alter same for use with a suction-operated method rather than a pressure-propelled method.

Additionally, there is no instruction or suggestion given in the reference as to how ice pigs of the disclosed shape and size could conceivably be simply pulled into the coil pipe from the hopper merely by the operation of an applied suction, as claimed, particularly since the disclosed method requires careful hand-loading and positioning of a pig into a tube prior to the applying of propelling pressure behind it.

The secondary Sameshima reference, which is cited for its teaching relating to applied suction and a supplied ice and water mixture, relates specifically to cleaning of waste and water supply piping in domestic plumbing. There is no indication that the same fouling agents present in sewer and water lines will have the same characteristics as those encountered in heat exchangers. For example, Barry et al. states that paraffin is a fouling agent in heat exchangers, and teaches that a pig is used to clear it from the tube. However, in a waste system, such as in Sameshima, it is doubtful whether such deposits of this nature are encountered. Hence, one skilled in

the art would not a have a reasonable expectation of success in cleaning heat exchangers by application of a flushing method relating simply to domestic pipes, particularly since the use of pigs, long used in the cleaning of heat exchangers, teaches that the pigs are propelled by pressure, and have a diameter large enough to scrape the accumulated deposits in the pipes as it passes therealong.

Lastly, Withers Jr., cited specifically for the premise of periodic flow reversal, lacks any disclosure providing the requisite motivation for combination of the references, or likelihood for success in cleaning heat exchanger tube(s) using a water and ice mixture drawn by suction into the tube(s) from a hopper merely by the operation of suction, that is missing from both Barry et al. and Sameshima. Thus, applicant respectfully submits that the Examiner is applying impermissible hindsight in making the combination upon which the rejection is based. Moreover, even if combined, the approach of Barry et al. would not be functional based upon its enabling disclosure. In particular, pigs of a diameter approximating an internal pipe diameter would not be drawn from a hopper by operation of applied suction since the pigs require careful positioning and alignment with the pipe entrance, and also would easily jam in an obstruction without high pressure behind the pig to clear the jam.

It is respectfully submitted that the rejected claims are not obvious in view of the cited references for the reasons stated above. Reconsideration of the rejections of claims 1, 7, 9 and 11 and their allowance are respectfully requested.

Claims 6, 8, 10 and 12 are rejected as obvious over Barry (US 4,724,007) in view of Sameshima (JP01-028625) and further in view of Withers Jr. (US 4,007,774) and further in view of Leon et al. (US 4,327,560) under 35 U.S.C. §103(a). The applicant herein respectfully traverses this rejection.

These rejection differ from those applied to claim 1 in regard to the additional Leon et al. reference, used for the teaching relating to the use of copper coils. Since Leon et al. fails to provide what is lacking from the remaining references, discussed above in detail relating to claim 1, in is respectfully submitted that a *prima facie* case of obvious has not been established. Therefore, reconsideration of the rejections of claims 6, 8, 10 and 12 and their allowance are respectfully requested.

Claims 13-17 are rejected as obvious over Barry (US 4,724,007) in view of Sameshima (JP01-028625) and further in view of Williams Jr. (US 5,499,639) under 35 U.S.C. §103(a). The applicant herein respectfully traverses this rejection.

As noted during the interview, none of the references teach the simultaneous passage of cleaning agents, such as ice, through parallel pipes interconnecting headers. Williams, Jr. cited as teaching that heat exchangers can have inlet and outlet headers to provide communication between a plurality of tubes, fails, however, to teach a method of cleaning such plural pipes (tubes) by simultaneous passage "internally through said at least two coil pipes." Rather, and in stark contrast with the present invention as claimed in independent claim 13, the tubes in Williams, Jr. are cleaned one at a time (See, for example, Fig. 1), as are the pipes in both Barry et al. and

Sameshima. As discussed during the interview, the claims are amended to positively recite the step of simultaneous passing the ice and water mixture through two coil pipes arranged between headers, to amplify this distinction.

It is respectfully submitted that the rejected claims are not obvious in view of the cited references for the reasons stated above. Reconsideration of the rejections of claims 13-17 and their allowance are respectfully requested.

Applicant respectfully requests a one (1) month extension of time for responding to the Office Action. Please charge the fee of $60 for the extension of time to Deposit Account No. 10-1250.

The USPTO is hereby authorized to charge any fee(s) or fee(s) deficiency or credit any excess payment to Deposit Account No. 10-1250.

In light of the foregoing, the application is now believed to be in proper form for allowance of all claims and notice to that effect is earnestly solicited.

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